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Effectiveness of Thinning Ponderosa Pine Stands in Reducing Mountain Pine Beetle-Caused Tree Losses in the Black Hills—Preliminary Observations[1]

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Three ponderosa pine stands thinned to less than 90 square feet stem basal area per acre sustained little tree mortality from mountain pine beetle attacks, while adjacent, unthinned stands continued to be affected. These results are consistent with subjective observations that thinning dense, second-growth ponderosa pine is effective in preventing unacceptable levels of beetle-caused tree mortality in the Black Hills.

Keywords: Thinning, *Pinus ponderosa*, *Dendroctonus ponderosae*

Management Implications

Thinning dense, second-growth ponderosa pine has long been recommended as a method for reducing losses caused by mountain pine beetle. These observations, coupled with managers' experience, show that this is a valid indirect control approach and element in an integrated pest management (IPM) system.

Introduction

Tree losses to mountain pine beetles (*Dendroctonus ponderosae* Hopkins) (MPB) are a serious problem in unmanaged, second-growth ponderosa pine (*Pinus ponderosa* Laws.) stands in the Black Hills of South Dakota and Wyoming. Analyses of conditions under which MPB outbreaks occur suggested that thinning might make stands less susceptible to outbreaks (Sartwell and Stevens 1975). Stands in the northern Black Hills have been extensively thinned. Subjective evaluations indicate that these thinned areas have generally escaped severe MPB infestations. However, no research has been done to verify this. This note reports results of preliminary work to demonstrate that thinning reduces typical MPB-caused losses.

[1]*The authors thank J. C. Mitchell, S. A. Mata, and P. A. Farrar for field work and other valuable contributions to this study.*

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Methods

In summer 1980, areas within the Black Hills National Forest known to have been thinned in recent years were selected for potential ground checking and further study based on (1) information from National Forest staff persons, (2) a search for these areas on available infrared optical bar aerial photos taken in the summers of 1978 and 1979, and (3) evidence on the photos of current MPB activity in the vicinity of the thinnings.

Initially, 18 areas were selected. Thirteen of these were eliminated from ground sampling for a variety of reasons, including (1) evidence of subsequent stand disturbances (e.g., clearcutting that included salvage of beetle-infested trees and firewood cutting that removed MPB-killed trees from either thinned or adjacent unthinned check areas) and (2) inability to clearly distinguish on the ground boundaries of thinned and unthinned areas. Of the remaining five areas considered suitable for sampling in the field, two were subsequently deleted when field work showed apparent collapse of the beetle outbreak in the area about the time thinning took place.

In fall 1980, the areas were cruised on the ground. Thinned areas were sampled at 5% intensity using one-tenth-acre circular plots taken at 3.5-chain intervals in parallel grid lines 5.5 chains apart. Adjacent unthinned areas, ideally extending 5 chains on all sides of the

thinned areas, were cruised at 2.5% intensity using (again ideally) a single line of 0.05-acre circular plots. Data collected for each plot included number and diameter of all living and dead ponderosa pines $\geq$ 3.0 inches d.b.h. Dead trees were checked to determine if, in fact, they had been infested by MPB; year of tree mortality was estimated by the amount and color of foliage remaining on the trees. Trees tabulated as killed in 1980 had full crowns of green foliage. Those killed by beetle attacks in 1979 had full crowns of fading foliage. Those classed as killed before 1979 were further deteriorated; the pre-1979 category included trees killed over several years' time.

Because of differences in topographic features and forest type, the unthinned check areas proved to be irregular in shape and were impossible to sample as prescribed. Nevertheless, in all cases, attacking mountain pine beetles could be expected to have had some choice in attacking trees in thinned or unthinned stands.

Results and Discussion

Thinning lowered the proportion of trees in the 5-9 inch d.b.h. range (fig. 1) and was followed by substantially reduced beetle-caused tree mortality in comparison with adjacent unthinned areas (table 1). Tree mortality in the thinned Englewood area was initially heavier than in the check (18.7 versus 4 trees per acre) but ceased after cutting in fall 1978. Some beetle activity also continued after thinning at Cheyenne Crossing, but at a markedly lower level than in adjacent unaltered areas.

Mean diameters of beetle-killed trees were slightly larger in the thinned areas than mean diameters in the adjacent, uncut checks (10.2 inches versus 9.9 inches for Cheyenne Crossing, Game Range No. 2 and Engelwood combined; differences were not statistically significant) and generally paralleled relative tree size in cut versus uncut areas.

If the risk rating of Stevens et al. (1980) is applied to the three areas, assuming all stands are single storied, thinned areas have considerably lower ratings than adjacent, unthinned checks, with the exception of Cheyenne Crossing. There both thinned and check areas have a risk rating of 18, just in the "high" category. However, the beetles selected the more dense stand

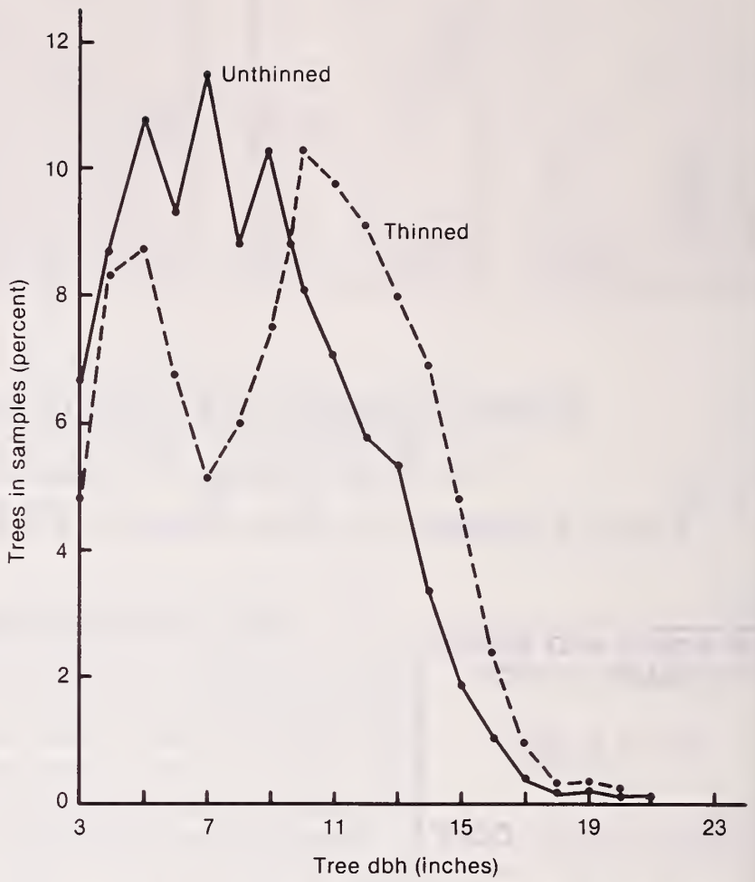

Figure 1.—Percent trees in diameter classes, thinned and adjacent unthinned areas, Black Hills National Forest, South Dakota, 1980.

with slightly smaller trees than the much more open stand with slightly larger trees. This is consistent with most subjective observations of beetle habits in the northern Black Hills. If this selection represents true beetle preference, it suggests that the numerical weight given to the three classes of stand density should possibly be increased in reference to those associated with the classes of tree diameter.

The influence of specific levels of residual basal area of ponderosa pine in the cut areas on susceptibility to beetle attack is not evident from this limited study. One point is consistently evident in the field; if thinned areas of relatively low average basal areas contain clumps of ponderosa pines whose diameters are adequate for beetle attack, these trees continue to be at

Table 1.—Mountain pine beetle-killed ponderosa pine, thinned (T) and adjacent unthinned check (U) areas, Black Hills National Forest, S. Dak., November 1980

	Cheyenne Crossing		Englewood		Game range	
	T	U	T	U	T	U
Approximate size (acres)	80	160	60	80	20	40
Year thinned	1979	--	1978	--	pre-1978	--
Mean tree d.b.h. (inches)	11.2	9.1	10.3	10.5	13.2	10.6
Mean stem basal area/acre (sq ft)	85	201	75	182	45	195
Mean number trees killed/acre						
pre-1979	6.0	15.3	18.0	4.00	2.0	6.0
1979	2.3	6.0	0	8.5	0	11.0
1980	0.5	7.5	0	14.5	0	0

risk. Cutting to an average basal area without regard to spacing of residual trees will not provide the desired protection of the residual stand from MPB attacks.

These data, limited as they are, provide evidence that MPB-caused tree mortality can be reduced by thinning. Many more questions can, of course, be asked (e.g., What are optimal thinning levels? Could epidemics develop in thinned stands?), but the approach generally works. Subjective observations of extensive areas thinned on the Limestone Plateau during the past 10 years indicate that no unacceptable losses are occurring. However, it is recognized that growth in these thinned areas will make some of them succeptible again within a few years. Managers need to stay alert to this possibility.

Thinning to limit beetle-caused tree losses may have different impacts on forest uses other than timber production (e.g., range, wildlife, esthetics). Where these considerations apply, trade-offs between actions favoring different resource values may have to be considered.

Results obtained in the Black Hills may be readily applicable to other, similar MPB-second growth ponderosa pine problem areas, such as the Front Range of the Rockies and other areas in Colorado. However, observations during actual MPB-outbreak conditions are the only way to test the thinning approach.

Literature Cited

Sartwell, Charles, and Robert E. Stevens. 1975. Mountain pine beetle in ponderosa pine. Journal of Forestry 73:136-140.

Stevens, Robert E., William F. McCambridge, and Carleton B. Edminster. 1980. Risk rating guide for mountain pine beetle in Black Hills ponderosa pine. USDA Forest Service Research Note RM-385, 2 p. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.

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